DRAFT MEMORANDUM

To: Earl Liverman, On-Scene Coordinator, United States Environmental Protection Agency

From: Steve Hall, START IV Removal Team Leader, Ecology and Environment, Inc.

CC: Tom Campbell, P.E., Ecology and Environment, Inc.
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Date: July 23, 2015

Re: Avery Landing Site
Draft Evaluation of Free Product Recovery System

The Environmental Protection Agency (EPA) has tasked Ecology and Environment, Inc. (E & E), under Superfund Technical Assessment and Response Team (START)-IV contract EP-S7-13-07, Technical Direction Document (TDD) 13-09-0012, to provide technical services for the Avery Landing Site in Avery, Idaho (Figure 1).

The Avery Landing Site (Site) is the location of a former railroad roundhouse, refueling, and maintenance facility for the Chicago, Milwaukee, St. Paul and Pacific Railroad that operated from the 1907 to the late 1970s. The facility was located on the bank of the St. Joe River near the town of Avery, Idaho. Over the years that the facility operated, petroleum (heavy oil and diesel) was released at the Site and became a light non-aqueous phase liquid (LNAPL) plume on groundwater that also seeped into the adjacent St. Joe River. After railroad operations at the Site ceased in the 1970s, the Site was acquired by several parties, including Potlatch Corporation (Potlatch), which used their portion of the Site for lumber-related activities; the Federal Highway Administration, which converted the former rail line right-of-way to a highway; and a private citizen (Figure 2).

EPA and the Idaho Department of Environmental Quality (IDEQ) both investigated the Site beginning in the 1980s. In response to these investigations, Potlatch installed a free product recovery system (FPRS) at the Site and operated it from 1994 to 2000. In 2000 Potlatch stopped operating the FPRS because it had been unsuccessful in preventing oil seeps to the river and installed an impermeable liner as a containment barrier along the bank of the river.

In 2012 and 2013, after the containment barrier also proved to be unsuccessful at preventing the release of oil to the St. Joe River, EPA and Potlatch performed removal actions at the Site, with EPA cleaning up the portion of the Site not owned by Potlatch in 2012, and Potlatch cleaning up their portion of the Site in 2013.

The current task from EPA involved a review of available information about the design and operation of the FPRS and its impact to the distribution of LNAPL at the Site. In addition to recovering oil for off-Site disposal, the design of the FPRS included the discharge of untreated groundwater to an area of the Site north of the highway that was believed to be previously uncontaminated (see below for more details). Additionally, on one occasion, Potlatch reported that the operation of the FPRS resulted in the discharge of oil to this area north of the highway. Given that the FPRS resulted in contaminated groundwater and oil being discharged to previously uncontaminated areas of the Site, EPA asked E & E to estimate, if possible with the available information, the degree to which the FPRS increased the quantity of contaminated Site materials requiring cleanup.

FPRS System Overview

The FPRS was installed in the fall of 1994 and included four extraction wells/trenches, a groundwater infiltration trench, and a 4,000-gallon oil recovery tank. Attachment 1 contains the record drawings for the system, and Drawing 2 in Attachment 1 presents a Site plan with the FPRS elements and locations. A report that described the details of the construction and installation of the FPRS was prepared by Potlatch's consultant Hart Crowser in 1994 (Hart Crowser 1994a).

Within each extraction trench was a recovery well, and two pumps were set inside each recovery well. The lower pumps were intended to pump groundwater to lower the groundwater level in the extraction wells, thereby creating a cone of depression in each well. The second pump within each extraction well was set at a higher elevation and was intended to recover LNAPL or oil that collected in the cone of depression caused by the groundwater draw-down.

The groundwater that was pumped from the extraction wells was injected to the subsurface through an infiltration trench that was located north of the highway (see Drawing 2 in Attachment 1). The infiltration trench was excavated to a depth of approximately 6.5 to 7.5 feet below ground surface (bgs). A 2-foot bed of crushed rock was placed as the infiltration bed, and the infiltration piping was installed at a depth of 4.5 to 5.5 feet bgs (Hart Crowser 1994a). There was no treatment of the groundwater prior to re-injection. Oil from the second (i.e., higher) set of pumps was collected in the 4,000-gallon oil recovery tank for later off-Site disposal.

The system was operated from late 1994 until 2000, and Hart Crowser prepared periodic monitoring reports while the system was operating. In 2000, the FPRS was shut down because it was not preventing the oil seeps in the river as intended, and Potlatch installed a containment barrier to attempt to prevent oil discharges along the bank of the river in 2000.

Site Hydrology

In general, groundwater flow at the Site has been estimated to be toward the southwest. Figure 3 shows groundwater elevations and a southwestern groundwater flow from September 1994. While the FPRS was operating, Hart Crowser measured and estimated changes in hydraulic gradients and contours caused by the operation of FPRS extraction well pumps. See Figure 4 from June 1995, which indicates a more southerly groundwater flow direction from the infiltration trench while the FPRS was operating. (Hart Crowser 1995)

The location of the groundwater infiltration trench upgradient of the source area (i.e., north of the highway) was intended to help remove LNAPL from the subsurface by using the injected water to push LNAPL towards the extraction trenches (Hart Crowser 1994b). A cross section of the Site on Drawing 3 (Attachment 1) indicates the relative elevation of the infiltration trench and the extraction trenches and also includes groundwater and surface water elevations in August 1989 and May 1990. Based on this cross section, the bottom of the infiltration trench north of the highway was located at an elevation that was approximately 5 to 10 feet higher than typical Site groundwater elevations.

Potlatch's consultant Hart Crowser noted on several occasions (e.g., December 1996 and December 1997) that the FPRS was not able to control groundwater at times, usually based on inoperable pumps or pumps set at the wrong elevation (Hart Crowser 1996, 1997), which may have been a contributing factor to the system's inability to prevent discharges of oil to the river.

Oil Discharge to Infiltration Trench

In the spring of 1999, Potlatch reported an incident in which oil was pumped through the groundwater pumps and discharged into the groundwater infiltration trench north of the highway. From the April 28, 1999, monitoring report:

> During weekly system monitoring done by Potlatch, free product was discovered in the ditch on the opposite side of the road. We planned to excavate the ditch to determine if the treatment system re-injection piping had a leak. On April 6, 1999, we excavated in the area of the re-injection trench and we discovered a significant amount of free product in the soil. While locating the injection piping we broke the pipe. We, therefore, could not tell if the pipe was already broken prior to our excavation. After repairing the pipe, the system was restarted. Once again, water was observed in the ditch about one week later. Other than residual free product in the ditch, no further free product has been observed since then. Absorbent booms have been placed in the ditch to catch any residual free product encountered.
>
> We have not been able to determine the source of the product in the soil above the re-injection piping. The source could be an unknown spill from the former storage tank that was located just up the hill. Another possibility is the treatment system water depression pumps are transferring free product from the extraction area to the re-injection area. To minimize the possibility of the total fluids pumps from transferring free product we reset the level control probes. This may reduce the system's ability to maintain groundwater capture. (Hart Crowser 1999)

The report indicates "an unknown spill from the former storage tank that was located just up the hill" as one potential source of the free product in the ditch. However, note that in the FPRS construction report there were no reported observations of free product or oil while excavating the injection trench (Hart Crowser 1994).

It seems more likely that the source of the oil observed in the ditch north of the highway was that "the treatment system water depression pumps [were] transferring free product from the extraction area to the re-injection area." This is consistent with what is known about the design of the FPRS; in order to work properly, the lower total fluids pump (i.e., the groundwater pump) in each extraction well would have to be set at the proper elevation to maintain a cone of depression without pumping LNAPL. As far as can be determined, the pump levels were set manually, and there were no mechanical systems in place to monitor groundwater or LNAPL elevations and automatically adjust the level of either the groundwater or free product pumps. It is also not clear from the monitoring reports how frequently Hart Crowser/Potlatch monitored or adjusted the levels of the pumps in response to changing groundwater or LNAPL elevations.

Also, note that although the oil was discovered in the ditch in the spring of 1999, there is no information that indicates that this was the result of a single discharge event. In other words, it is possible that the oil discharges to the infiltration trench had been happening periodically or routinely for some time before it eventually was observed above the ground surface.

Based on the location of the infiltration trench and the groundwater flow direction during the operation of the FPRS (Figure 4), it is likely that oil discharged from the infiltration trench north of the highway would have migrated to the south.

LNAPL Plume Area Estimates

The first known estimate of the extent of the LNAPL plume at the Site was prepared by Hart Crowser for Potlatch based on test pits excavated in June 2000 (Figure 5). This 2000 plume estimate indicates that the northern boundary of the LNAPL plume is south of the highway, based on the observations of no visible free product in Test Pit (TP)-4. However, note that no test pits were excavated north of the highway in the area of the infiltration trench (Hart Crowser 2000).

During the 2000 test pit investigation, Hart Crowser installed a slotted PVC pipe for future LNAPL and sheen monitoring (i.e., "test pit monitoring wells") in any test pit where free product was observed, and

these wells were included in Site monitoring performed until 2005. Because a test pit monitoring well was not installed at the TP-4 location, no data for that location south of the highway was recorded through subsequent monitoring, so it is not known whether or to what degree the oil discharged to the infiltration trench north of the highway in 1999 or earlier may have migrated to the south or southwest.

Hart Crowser and Potlatch monitored the various Site monitoring and extraction wells over time from 1994 through 2005. Figure 6 includes a map of the various monitoring wells, extraction wells, and slotted PVC pipes (i.e., test pit monitoring wells) located at the Site, and it includes the maximum amount of product recorded and the year for each of these wells. The test pit monitoring wells at test pit locations TP-3 and TP-5 are most directly south of the infiltration trench area, on the south side of the highway. In both of these wells, sheen was observed on the initial monitoring period in June 2000, while later, in 2001, monitoring indicated traces of oil in both.

As indicated above, the first known LNAPL plume area estimate was prepared in 2000 by Hart Crowser on behalf of Potlatch. Since then, additional LNAPL plume area estimates have been prepared as a result of subsequent investigations, including EPA in 2007, Golder Associates (on behalf of Potlatch) in 2009, and the FHWA in 2011. These estimated LNAPL plume areas are indicated on Figure 7, as well as the excavation area from EPA's 2012 removal action (which only included the eastern half of the Site; Potlatch completed the removal action on their western half of the Site in 2013).

During EPA's 2012 removal action, excavation of oil-contaminated soil extended to the north of the highway. While excavating the ditch to the north of the highway and removing the piping associated with the FPRS, EPA observed oil around and below the infiltration pipe.

The various LNAPL plume area estimates and the 2012 EPA excavation were digitized in GIS. The areas of each, including the area located within the highway right-of-way, are presented in Table 1. In general, each subsequent investigation resulted in an expanded estimated LNAPL plume area, although it is not clear whether this is because the LNAPL plume continued to expand during this time or because the investigations became more accurate as they built on previous investigations and focused on areas that required additional delineation. Also, note that these LNAPL plume estimates are of the horizontal area, only, and do not include depths or volume estimates.

Table 1, Size of LNAPL Plume Area Estimates

Description	Year	Total Area (acres)	Total Area (ft^2)	Area within the Highway ROW (acres)
Plume Estimate (Potlatch / Hart Crowser)	2000	2.01	87,633.79	0.22
Plume Estimate (EPA)	2007	3.11	135,538.72	0.66
Plume Estimate (Potlatch / Golder)	2009	3.60	156,878.97	0.60
Plume Estimate (FHWA) Note: includes the ROW only	2011	0.91	39,490.21	0.91
Excavation Area (EPA) Note: only includes the eastern portion of the Site	2012	3.06	133,474.39	1.12

ft^2 square feet
ROW right-of-way

1.

Conclusion

The available information indicates that that the design and operation of the FPRS from 1994 to 2000 did result in the discharge of Site contaminants to previously uncontaminated areas of the Site, which almost certainly resulted in an expanded LNAPL plume area and therefore an increased quantity of contaminated material requiring cleanup. These contaminants included recovered free product that had been discharged into the infiltration trench, which was observed at the surface in 1999 after the FPRS had been operating for approximately four years. The fact that oil was visible at the surface above the infiltration trench (installed at a depth of 6.5 to 7.5 feet bgs) and oil-contaminated soil was still present in this area by the 2012 removal action suggests that the discharge of oil in the groundwater infiltration trench may not have resulted from a single incident. Rather, it is possible that improperly placed groundwater and oil recovery pumps in the recovery wells and the lack of any additional groundwater treatment prior to discharge led to multiple if not ongoing releases of oil to the area north of the highway. Additionally, Site contaminants in the form of dissolved-phased constituents in the untreated groundwater would have been routinely discharged to the infiltration trench as part of the normal operation of the FPRS.

However, based on a lack of relevant data, it is difficult to quantify the amount of additional contaminated soil at the Site caused by the operation of the FPRS. The various Site investigations generally did not include test pits or boreholes north of the highway in the area of the infiltration trench, so little is known about the horizontal extent of oil or LNAPL in this area until the 2012 removal action. Additionally, the LNAPL plume area estimates are presented as horizontal extents of contamination, but there was very little data to define the vertical delineation of the LNAPL plume in these areas. Even if the horizontal area estimates were reasonably accurate, there is little to no data on the vertical extent of contamination on which to perform volume or quantity calculations. So, while it is very likely that the operation of the FPRS did cause an increased quantity of contaminated media at the Site, it would be difficult to calculate the amount of the increase with reasonable certainty.

References

Hart Crowser, Inc., August 7, 2000, *Corrective Action Plan, Avery Landing Site, Avery, Idaho*, prepared for Potlatch Corporation.

_____, April 28, 1999, *First Quarter Performance Report for 1999, Avery Landing Recovery System*, prepared for Potlatch Corporation.

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_____, July 31, 1995, *First Quarter Performance Report, Avery Landing Recovery System*, prepared for Potlatch Corporation.

_____, December 23, 1994a, *Construction Report for Free Product Recovery System (FPRS), Avery Landing, Idaho*, prepared for Potlatch Corporation.

_____, July 27, 1994b, *Draft Final Design of Free Product Recovery System (FPRS), Avery Landing*, prepared for Potlatch Corporation.

Attachment 1
FPRS Record Drawings